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# ANACOSTIA WATERSHED RIPARIAN FOREST BUFFER STUDY



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# Anacostia Watershed Riparian Forest Buffer Study, Summer 1997

SEP 7 2 2014

**Prepared by:**

Andrew Mintz, Forestry Associate

David Plummer, Anacostia Watershed Forester

Bill Brumbley, Forester

The following study was completed by the Maryland Department of Natural Resources – Forest Service for the United States Forest Service as part of a grant to study urban reforestation efforts along streams in the Anacostia watershed.

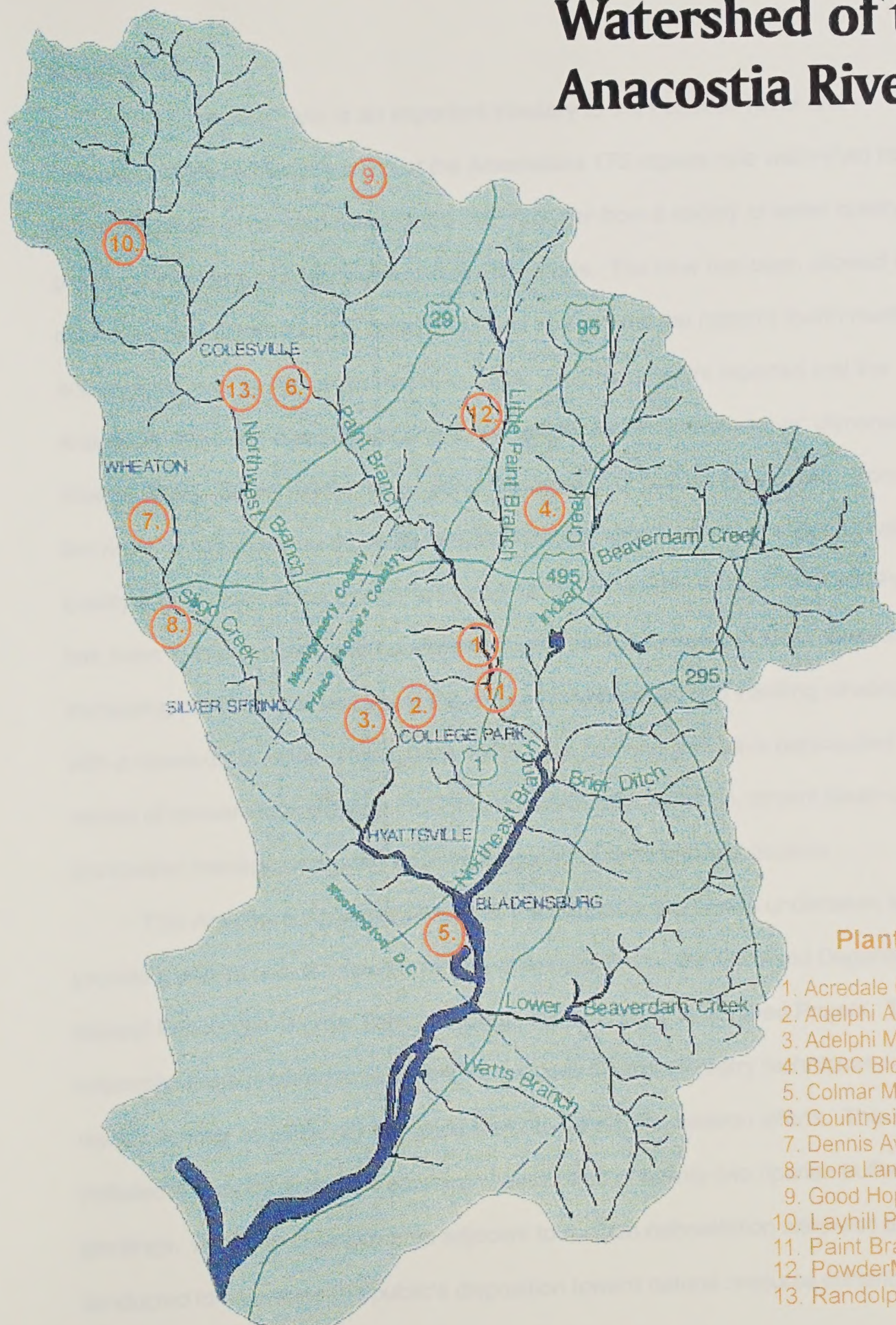


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# Watershed of the Anacostia River



## Planting Sites

1. Acredale Community Park
2. Adelphi Archery Range
3. Adelphi Manor Park
4. BARC Bldg 011A
5. Colmar Manor Yost Park
6. Countryside SWM Pond
7. Dennis Avenue SWM Pond
8. Flora Lane
9. Good Hope Rd.
10. Layhill Park
11. Paint Branch and Rte. 1
12. PowderMill Rd. and I95
13. Randolph Rd.



## **Introduction**

The Anacostia River is an important tributary to the Potomac River and Chesapeake Bay. A large portion of the Anacostia's 170 square mile watershed has been intensively urbanized causing the river to suffer from a variety of water quality problems including high sediment and nutrient loads. The river has been allowed to degrade to the extent that the Anacostia River was ranked the nation's fourth most endangered river by American Rivers in 1993. American Rivers reported that the Anacostia "typifies the appalling condition of America's urban waterways" (American Rivers, 1993). Since 1993, the Maryland Department of Natural Resources - Forest Service has administered the Anacostia Watershed Project (AWP) to enhance water quality and wildlife habitat along the tributaries of the Anacostia River. The AWP's goal has been to improve the urban environment with the involvement of local communities, increasing public awareness about the Anacostia watershed and instilling inhabitants with a stewardship ethic. Through the AWP, local communities have participated in a variety of conservation projects including volunteer tree plantings, stream clean-ups, stormwater management pond reforestation, and streambank stabilization.

This Anacostia Watershed Riparian Forest Buffer Study was undertaken to provide a pool of data for riparian forest buffers planted by the Maryland Department of Natural Resources - Forest Service through the Anacostia Watershed Project. This information was required to evaluate the success of urban forestry techniques so that resources may be efficiently allocated towards future afforestation efforts. This study included a comprehensive inventory and evaluation of twenty-two riparian buffer plantings. A survey of landowners adjacent to riparian reforestation sites was also conducted to determine the public's disposition toward natural resource enhancement in



their communities. Riparian forest buffers are ecologically vital for improving water quality in the Anacostia River and the Chesapeake Bay. Riparian forests remove suspended sediment and nutrients (such as nitrates and phosphates) from storm water runoff, stabilize stream banks, shade streams to keep water temperatures cool, and provide a source of food and habitat to aquatic and terrestrial wildlife.

**Buffer Inventory:**

The main objectives of the buffer inventory consisted of cataloging tree survival, determining tree density, assessing the frequency and cause of tree damage, qualitatively describing each planting site's ecology, and measuring the buffer planting dimensions. One of two important aspects of the study was the comparison of tree survival among seedling trees and containerized trees. The other aspect was to determine if there was a significant difference in containerized tree survival for spring and autumn planting times. Finally, a database containing details about each planting site was designed and implemented to organize and maintain the data collected from the inventory. The success of future riparian buffer plantings will be improved through the analysis of the data collected during the inventory process.

**Landowner Survey:**

The primary objective of the landowner survey was to obtain information on how communities relate to riparian buffer planting sites. Questions explored the public's familiarity with the planting sites, their understanding of the reason behind the plantings, and their general knowledge concerning the impact of urbanization and the benefits



riparian trees provide to water quality. Landowners were also asked for opinions on the planting sites, willingness to participate in future volunteer planting efforts, methods in which landowners receive news about community events, water quality problems they may have noticed with local streams, and about their awareness of the relationship between streams and the Chesapeake Bay. Last, respondents were asked about their awareness of the Multi-State effort to restore water quality in the Chesapeake Bay.

The goal of this part of the study was to discover ways of further involving the community in the riparian buffer reforestation effort and to ascertain the level of public understanding and interest about buffer plantings in their community. Community feedback will assist the Forest Service in incorporating communities' needs with those of the environment to ensure successful future ventures and achieve a common goal. The responses obtained from this survey will provide essential information for laying the foundation of an outreach program to raise public understanding and interest regarding riparian forest buffer plantings.

## **Methods**

### **Buffer Inventory:**

All riparian forest buffer planting site dimensions were measured in the field with the use of a measuring tape. Length was measured on the side of the planting roughly parallel to a stream. For determining the outside edge of a planting site in order to measure width, the drip line of the planted trees furthest from the stream was used. The inside edge of a planting site was determined by the drip line of the planted trees closest to the stream. Width was measured from the outside edge of the planting to the



inside edge along a line approximately perpendicular to the outside edge. Width measurements were taken at the planting site's beginning and end, as well as at intervals of 100 feet along the outside edge. Where possible, area was estimated by dividing a planting site into geometrical sub-units and totaling the individual areas. For planting sites with complicated layouts, area was estimated from buffer length and average buffer width.

Sampling points were placed randomly along sampling lines perpendicular to the outside edge of the planting site. These lines were located at 50 feet from the beginning of the buffer and at each additional 100 feet of buffer length, as long as there was at least 50 feet between the buffer end and the sampling line. For plot size, 20<sup>th</sup> acre plots were used when possible while 50<sup>th</sup> acre plots were used on sites with narrow buffer width. Only one plot size was chosen for each site to prevent inconsistent data collection. Two planting sites had no sampling points and were inventoried with a 100% tally. Sample plots were measured using a logger's chain attached to a plot center and had a radius of 26.3 feet for 20<sup>th</sup> acre plots, or 16.7 feet for 50<sup>th</sup> acre plots. The field technician recorded data for any tree with a trunk more than 50% within the plot radius. For a 100% tally, all trees within the dimensions of the buffer planting were recorded. Trees were examined to determine species, type (container, seedling, or volunteer), if the tree was living or dead, and the type of any damage the tree had suffered. The presence of nearby invasive species was also recorded along with maintenance needs. Damage was grouped into eight categories consisting of impacts from deer rubbing by bucks, deer herbivory, insect damage, rodent damage, machine or vehicular damage, beaver damage, disease, and last a group for any other cause of tree damage.



Although beaver are rodents, they were placed in a separate category due to the severe potential impact they have on riparian forests. A tree was considered damaged as long as signs of damage were evident even if the tree was otherwise apparently healthy.

To determine tree survival, the original number of container trees and seedlings planted at each site (obtained from planting records) was divided by the measured buffer area to arrive at the original planting density. Surveyed plantings' densities and the original planting densities were used to calculate the percent of trees still surviving.

Riparian forest buffer plantings were also qualitatively evaluated for a variety of ecological factors. Information recorded for streams included stream bank condition, substrate embeddedness, stream sedimentation, water odor, water discoloration, presence of suds or froth, extent of algae present in the water, canopy cover, and presence and extent of trash and debris in the stream. Soil was examined on site to determine soil compaction and the amount of gravel, rubble, or debris. Notes were also taken on adjacent land use, observed wildlife, and the number of interpretive signs present. Last, potential sites for future forest buffer plantings were recorded. The riparian buffer inventory forms are shown in Appendix B.

### **Landowner Survey:**

The landowner survey was conducted in four communities adjacent to Maryland Department of Natural Resources - Forest Service riparian buffer plantings. Thirty-eight respondents filled out the questionnaire. The results of the four locations were pooled to increase the number of replicates, allowing for better statistical accuracy. The four locations: Colmar Manor, Adelphi, Countryside, and Good Hope Rd are all located in the



Anacostia watershed and represent a diverse ethnic and economic spectrum. A copy of the questionnaire is included in Appendix C.

## **Results**

### **Buffer Inventory:**

From this study, twenty-two riparian plantings were inventoried for a combined length of 11,619 feet (approximately 2.2 miles) of riparian forest with an average width of 85 feet. This equates to approximately 18.53 acres of new riparian forest in a highly urbanized watershed as a direct result of the Anacostia Watershed Project (Table 1). Twenty of the twenty-two planting sites studied were found to have greater than 200 trees per acre (Fig. 1). Including natural regeneration, three planting sites had densities greater than 1200 trees per acre (Fig. 1). The majority of planting sites had greater seedling tree density than container tree density (Fig. 2). Most planting sites possessed a much higher container tree survival rate than seedling tree survival (Fig. 3). Only three of the nineteen sites planted with container trees have survivals below 60%. In contrast, nine of the fourteen sites planted with seedlings have seedling tree survival rates below 45%. Although four of the seedling tree sites have a very high survival near or above 80%, two of these sites have never had container trees planted. Of the eleven sites with both container trees and seedlings planted, all but three plantings show container trees as having greater than a 20% higher survival rate than seedling trees. The remaining three planting sites have seedling survival rates only marginally higher than container tree survival rates.



There is only about a four and a half percent higher survivability for fall plantings than spring plantings (Fig. 4A). Taking into account the standard error of the means, there may be very little significant difference between the fall and spring planting season. Planting densities for container trees were much higher in the fall (Fig. 4B).

Over 50% of the trees were damaged at four of the planting sites, with three of those sites having tree damage higher than 75% (Fig. 5). Five sites had no surveyed trees with any sign of damage evident. Deer herbivory was the leading cause of tree damage among the inventoried planting sites, affecting over a third of all surveyed trees (Fig 6). Rodents were the second most frequent cause of tree damage with 'other' causes of tree damage a close third. 'Other' was most often apparently drought damage, severe die back of the top of a tree for unknown reasons, and occasionally severe competition with vines. Lawn mower damage from mowing crews and trampling damage from construction vehicles also contributed considerably to tree damage, followed closely by damage caused from male deer rubbing their antlers against tree bark. Insect, beaver and disease damage contributed only slightly to tree damage.

### **Landowner Survey:**

Participants in the landowner survey have resided in their respective communities an average of 17 years. Newspapers and local papers were used by over 50% of the respondents as an information source for learning about local events (Fig. 7). All other sources of information were shown to be significantly less effective.



Figure 8 illustrates the distribution of responses to questions asking respondents to strongly agree, agree, neutral, disagree, or strongly disagree with the statement. Of particular interest is the large percentage of respondents with neutral or some positive feelings towards participating in future planting efforts. An overwhelming majority of respondents were positive or very positive towards the planting sites in their community. Most respondents also showed a fair awareness of the benefits of trees to the Chesapeake Bay, the negative impact of urbanization to the Chesapeake Bay, and familiarity with the Multi-State Chesapeake Bay restoration effort. While over 60% of respondents agreed or strongly agreed that their local stream ultimately reaches the Chesapeake Bay, nearly 35% were uncertain or certain their stream did not.

Figure 9 shows results of the landowner survey's yes or no questions. Almost two thirds of respondents were familiar with a stream in their community and over half the people surveyed were aware that volunteers had planted trees along that stream. Nearly 15% of those surveyed stated that they or someone in their family had participated in the volunteer tree planting effort. Trash was the most frequently observed water quality problem with 45% of respondents having concerns with trash in local streams (Fig. 10). Nearly 35% of respondents had noticed no water quality problem with their stream.



## **Discussion**

### **Buffer Inventory:**

The riparian forest buffer plantings were successful for many reasons. All of the planting sites surveyed are becoming established riparian forests. In addition, local communities were directly involved in the restoration of urban natural resources. Even Adelphi Manor Park site B with an apparently low tree density of 147 trees per acre is acceptable when considering the high container tree survivability. Adelphi Manor Park site B has an estimated 120 container trees per acre. These trees are well developed 1" to 2" caliper trees and the site is well along the process of succession from meadow to forest. In the case of Adelphi Park site B, heavy herbaceous competition is the likely reason for poor natural regeneration growth, keeping total trees per acre lower than desired. Heavy herbaceous competition is the most likely reason some of the sites had poor volunteer trees per acre. Nearly the entire site by BARC building 011A has been mowed repeatedly by grounds keepers. This has resulted in very low regeneration except for a narrow strip adjacent to the stream. Despite mortality due to mower damage, this site has a very successful container tree survival of 73%. Carderock U.S.N.W.C site A is unusual in that the grass has laid down flat for most of the site, but even though seed sources were nearby, volunteer tree regeneration was surprisingly low.

The higher rate of container tree survival over seedling tree survival is a result of competition between seedlings and grass/weed species. Another possible explanation is that damage which may be evident upon a container tree as a mild stress may be enough to kill a less developed seedling. Container trees inherently have a higher



survival rate than seedlings because they have a larger root mass when planted.

Seedlings are planted in much higher densities to compensate for their higher mortality rate.

Sometimes it was difficult to locate the boundaries of a planting site due to tree mortality. Slight discrepancies in measurement may have resulted in the introduction of some error on one or two sites, possibly causing the calculated survivability (which is based on measured dimensions to determine acreage) to be slightly off. Another possible source of error for survivability may have occurred if another organization conducted a reinforcement planting amid any of the surveyed planting sites. This would raise the observed density without raising the original planting density, inflating survival rates. Due to these influences, equating survival with the monetary investment for container trees and seedlings would be inaccurate and possibly misleading. Since container trees are much more expensive than seedlings, it would be useful to determine which is most cost effective. A study performed under controlled conditions, with some proper planning, could be conducted to determine this valuable information.

The results of comparing container tree survival by planting show that there is only a slightly higher survival rate for fall plantings over spring plantings. With a low standard error, this data is reliable and shows no significant difference in survival between fall and spring plantings. Fall plantings' container tree densities were much higher than spring planting densities as a result of more container trees being planted in the fall when seedling trees are not planted. Seedling trees have a higher planting priority in the spring requiring that less container trees are planted, due to limited resources.



Damage to surveyed trees was assessed to container, seedling, and volunteer trees, but because of their high monetary cost, container trees are the focus of this discussion. The majority of planting sites surveyed were not dominated by damaged container trees. Deer, rodents, and drought were the major causes of tree damage. Providing a watering regime during dry seasons, especially for the first year after planting, could improve survival rates considerably. Due to the cost and labor involved in watering planting sites, a study should be conducted to determine the effectiveness of a watering regime. The area studied is notorious for a large urban deer population so the impact deer had on buffer trees was less than what was expected. Herbaceous plants were heavily browsed at several sites with only low to moderate deer herbivory damage to container trees, suggesting that trees are browsed most when herbaceous plants are unavailable. Rodents were the second most frequent cause of surveyed container tree damage. Providing nesting boxes for owls may be an inexpensive way to control rodent populations. Nesting boxes would help reestablish urban owl populations and reduce damage to trees from rodents.

Only three locations had very high ratios of damaged container trees. The site suffering the most damage has already been mentioned but deserves a second look. The riparian forest buffer planting by BARC building 011A was one of two sites where a 100% tally of every tree in the planting site was conducted. Due to this, the data collected for this site is highly reliable. Of 150 planted container trees, 110 were surviving. The 40 trees unaccounted for are thought to have been mowed. Unfortunately, 100 (or over 90%) of these otherwise healthy trees have been damaged exclusively by irresponsible mowing and trimming. Due to the previously mentioned



lack of natural regeneration, it may be necessary to conduct a reinforcement planting at this location. This example stresses the importance of 'no mow' buffer management.

It is important to stress that by ceasing to mow an area, the field is allowed to regenerate from natural seed sources and will eventually become a forest. The regeneration process is accelerated because the 'no mow' area provides habitat for wildlife. Birds and small rodents take refuge in the planting area and provide a new source of seeds through their droppings. In this manner riparian forest buffer plantings accelerate the natural regeneration process. If herbaceous weeds and fescue competition can be reduced through good site management, natural regeneration should easily replace lost trees. The buffer planting also provides diversity, where natural regeneration can favor one or two specialized species. For example, Carderock U.S.N.W.C site B had very high regeneration, but most of this was boxelder (*Acer negundo*). Flora Lane also had high volunteer trees per acre, but these were almost exclusively boxelder. Red maple (*Acer rubrum*) was found responsible for the high volunteer trees per acre at Countryside site B. Even so, although these very high densities of boxelder and red maple may not be as desirable as a more diverse mix of tree species, the dense thickets of tree stems outcompete grasses and weeds and assist the site in becoming a riparian forest.

During the course of the buffer inventory, three planting sites were discovered to have been heavily impacted by beavers. Although these sites had very few living trees with beaver damage, a large number of trees had been killed by the rodents. The beavers preferred large container trees closest to the stream bank. These trees are not only expensive to plant, but are located in the most important area of the buffer



plantings. Although a beaver was never sighted, the signs of damage were very recent at the time of observation. Beaver have the potential to be very destructive and may severely impact the riparian forest buffers.

The exotic invasive vine mile-a-minute (*Polygonum perfoliatum*) was present at the majority of the planting sites. This vine spreads very rapidly and is difficult to control. It is very competitive and can quickly overrun a planting site. Several of the surveyed sites already have an extensive amount of mile-a-minute, impeding natural regeneration. The presence of sharp needle-like spines and thorns makes mile-a-minute extremely difficult to remove. Prison work details could possibly be used for removing this invasive species from the buffer planting sites. Wild grape (*Vitis spp.*) was also problematic at several sites. Although a native vine species, wild grape can also be competitive. One planting site contained two trees that have been pulled to the ground by wild grapevines.

### **Landowner Survey:**

Over half of the landowners surveyed indicated that they receive information on community events through newspapers or local papers (Fig. 7). No other source of news was nearly as effective at informing communities about local concerns. From this information, it is clear that the best way to inform the public about upcoming buffer plantings is through local newspapers. A short article explaining the reasons for and details of a planting should help generate support by raising community awareness and possibly generating additional volunteers. Good publicity can also be generated through local community newsletters where available. Overall, newsletters can not be



solely relied upon since they are not present in many communities. Lack of newsletters in some of the surveyed communities explains why so few of the respondents listed newsletters as an information source.

The answers landowners submitted to questions concerning riparian buffer awareness indicate that a good majority of the public has a basic understanding of the need for urban riparian forests. Results have indicated that educational programs must continue to work with the public to raise ecological awareness and instill a stewardship ethic. Most importantly, results of the survey show that previous work to educate the public about the Chesapeake Bay has had a strong positive impact on public awareness.

Understanding that their community's stream plays a part in the ecology of the Chesapeake Bay will help landowners realize that local problems have an affect downstream and ultimately on the Bay itself. All the streams in the surveyed communities were tributaries of the Chesapeake Bay. Slightly more than 60% of landowners reported familiarity with a stream in their community. Over 60% of respondents correctly knew that their community stream eventually flowed into the Bay (Less than 40% of the respondents were uncertain or believed their stream did not reach the Bay). The survey has shown that some education of the public is necessary concerning the destination of local streams.

An overwhelming majority of respondents expressed positive feelings about the planted riparian forest buffers. Over half of the respondents reported that they agreed strongly when asked their position towards the planting sites. Fifty four percent of those surveyed knew that trees along their stream had been planted by volunteers and fifteen



percent of respondents had actually participated in the planting. Residents of the surveyed communities have noticed the buffer plantings and expressed their approval.

Nearly 45% of landowners responded that they maintained neutral feelings towards participating in future buffer plantings. This shows a tremendous potential resource to be garnered, if an effort is made to win these people over. An outreach program to educate this neutral portion of the public about the benefits of riparian forests could generate large numbers of volunteers. This pool of potential aid is an important resource since most MD D.N.R. Forest Service buffer plantings in the Anacostia watershed are undertaken by volunteers from the community.

The landowner survey also showed that a large number of respondents (about 70%) were aware of the Multi-state effort to restore the Chesapeake Bay. Roughly, 75% of landowners believed trees are beneficial to streams and the Bay. Over 80% of respondents felt that urban areas have a negative impact on the Chesapeake. These results show a good basic level of public understanding concerning ecological issues.

Another part of the landowner survey questioned landowners about any water quality problems they had observed (fig. 10). Trash was the most frequently observed stream problem, reported by nearly half of the respondents. Landowners were also concerned with pollution and erosion. Flooding was a concern to about 5% of residents. About one third of the respondents have not noticed any stream problems. During the riparian buffer inventory, one of the streams in the surveyed communities was found to have a very large quantity of trash and badly needs a cleanup. Several stream cleanup projects have been carried out at that location in recent years, but the trash is a



reoccurring problem. Street and sewer runoff is the most likely source of trash in these streams, and will continue to be problematic as long as careless trash disposal occurs.

**Summary:**

Riparian forest buffers are the most cost effective method for improving water quality in the Anacostia watershed. As the planted riparian forests mature, the many benefits they provide grow with them. Reestablishing natural resources in urban areas is critical to improving the water quality of urban streams, rivers, and the Chesapeake Bay. In a time of shrinking budgets and diminishing resources, the ability to direct efforts toward effective methods of habitat and water quality restoration has become essential. Instilling a stewardship ethic in local communities will provide a valuable resource to aid the Forest Service in restoring the Anacostia River and it's watershed. Restoration work accomplished by the Anacostia Watershed Project directly benefits the Potomac River and the Chesapeake Bay, ensuring that future generations will be able to enjoy these bodies of water.



**References**

American Rivers. 1993. Endangered Rivers of America.



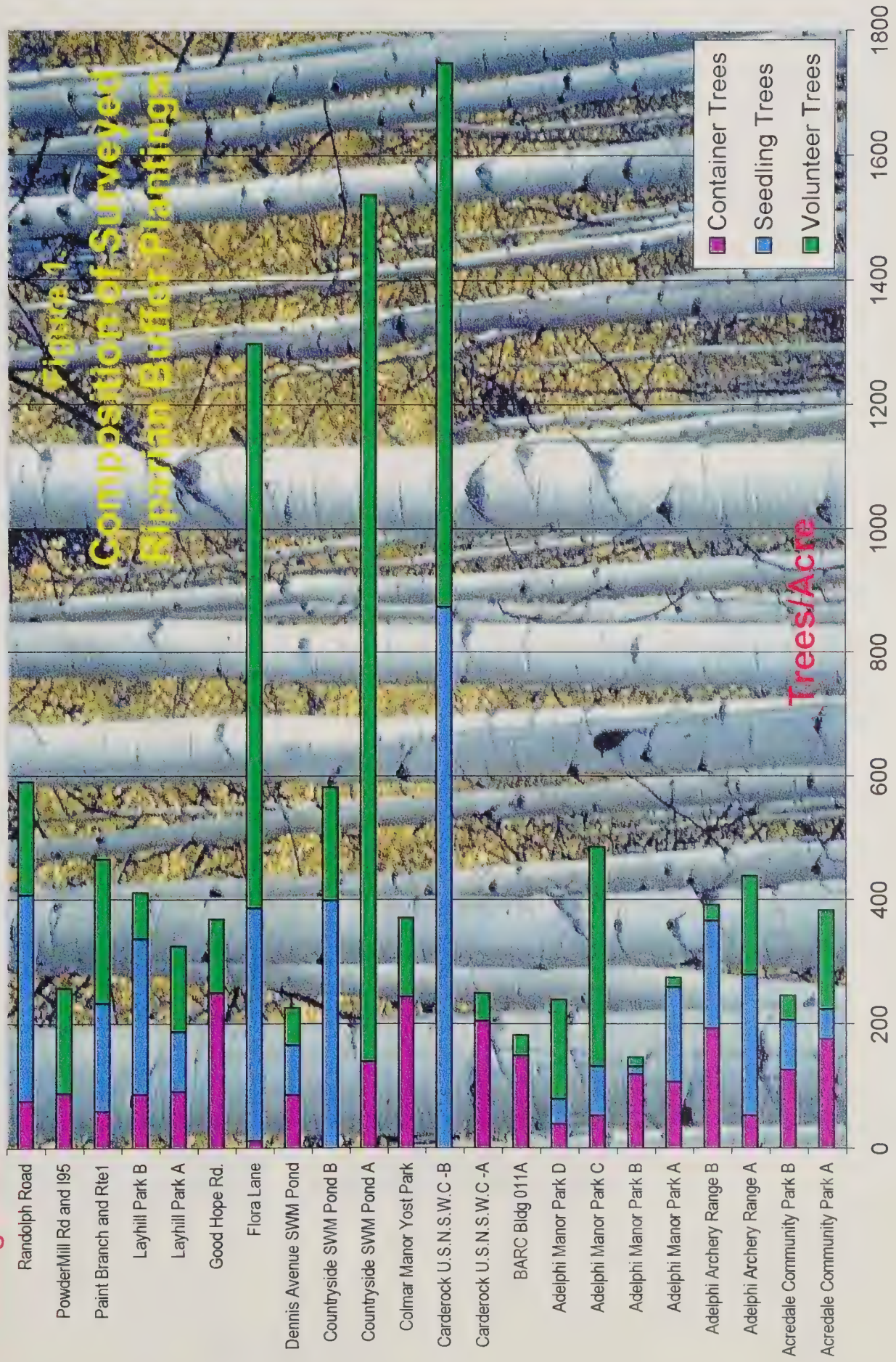
# **Appendix A**

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Charts, Tables, and Graphs.



## Planting Sites









**Figure 3.**  
**Comparisson of Survival in Planted Seedlings**  
**and Container Trees.**

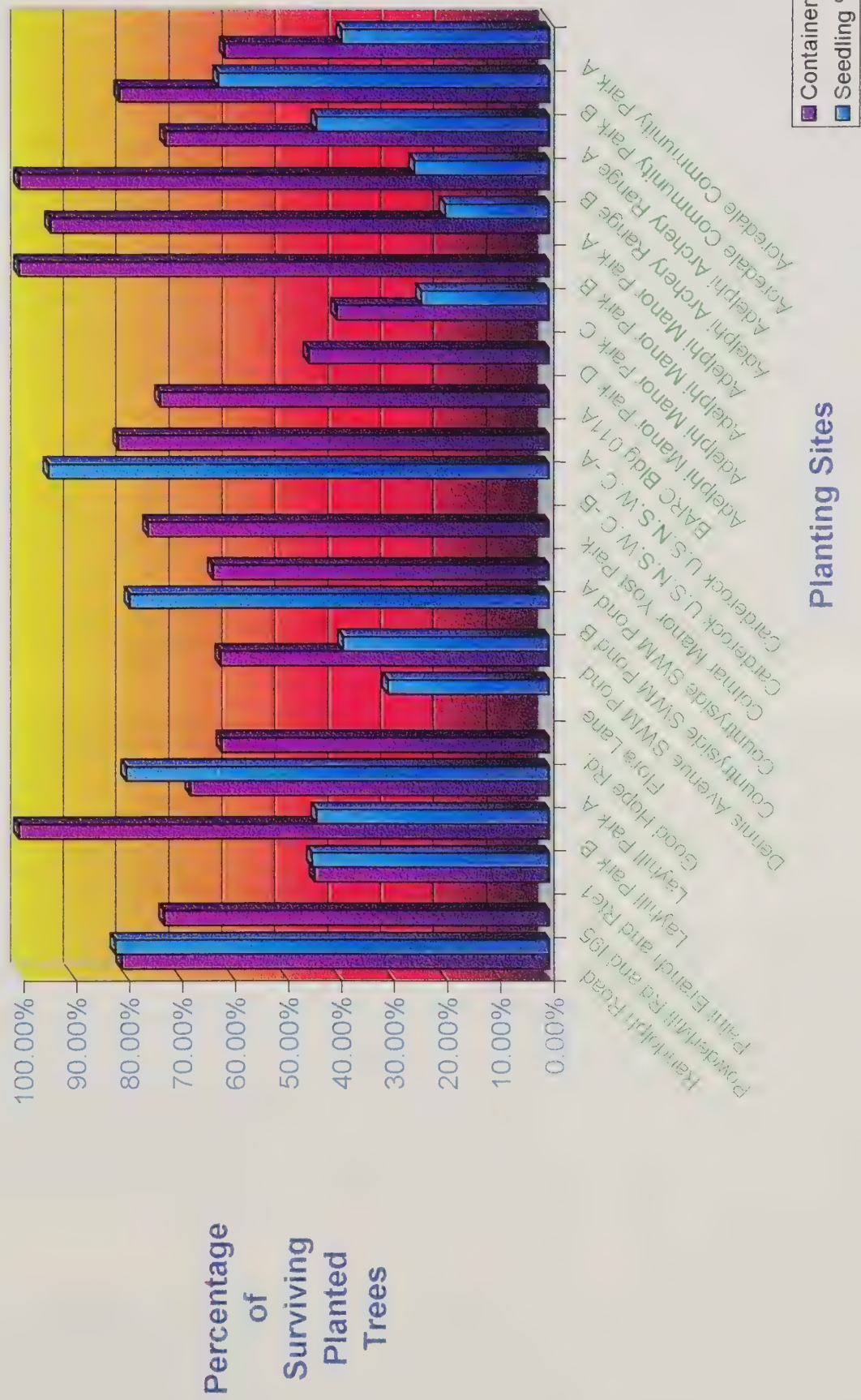




Figure 4A

Container Tree Survival Compared by Planting Season  
With Standard Error of Means.

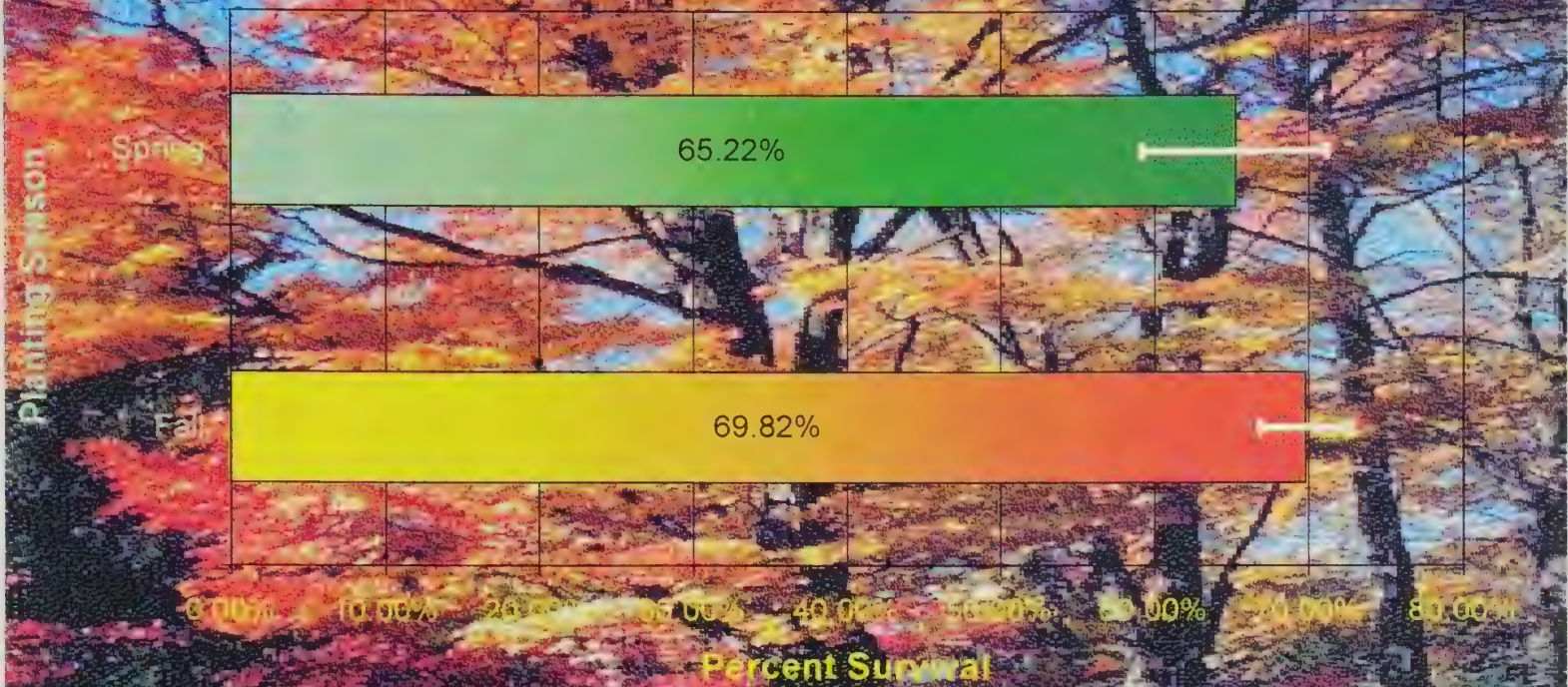
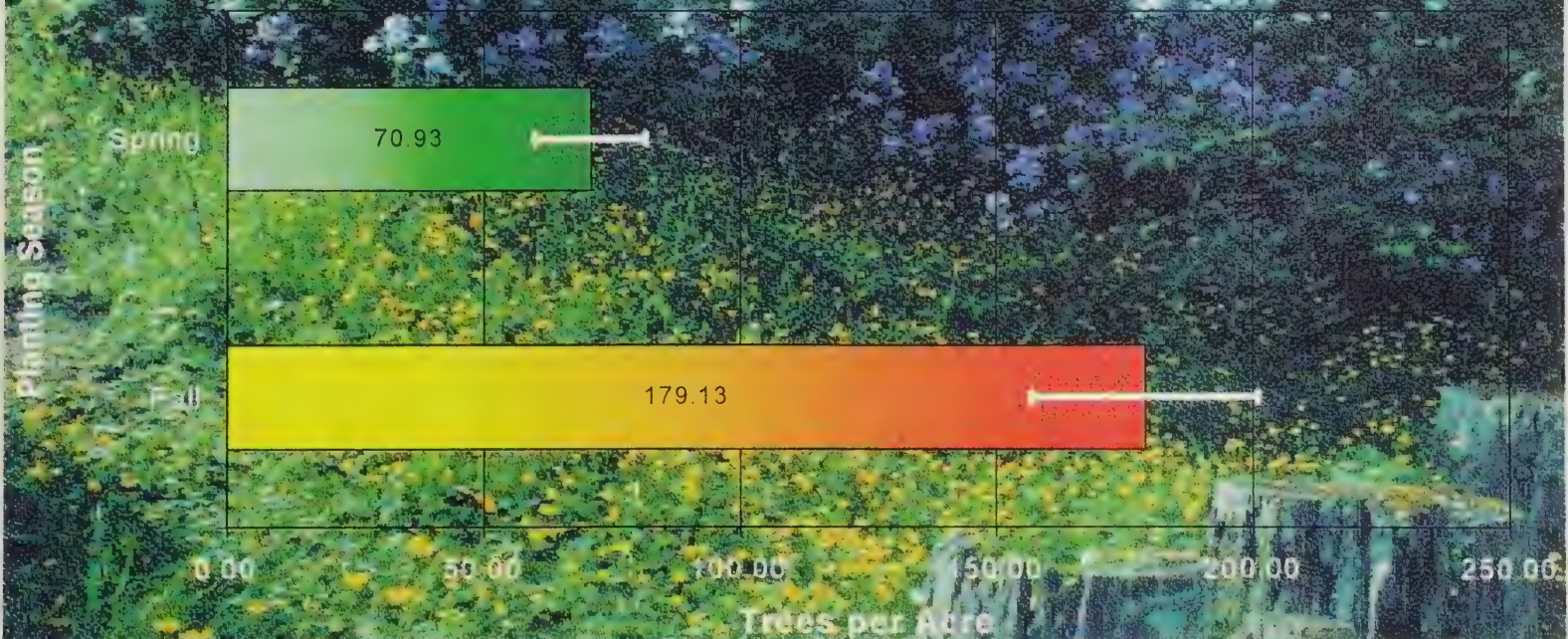


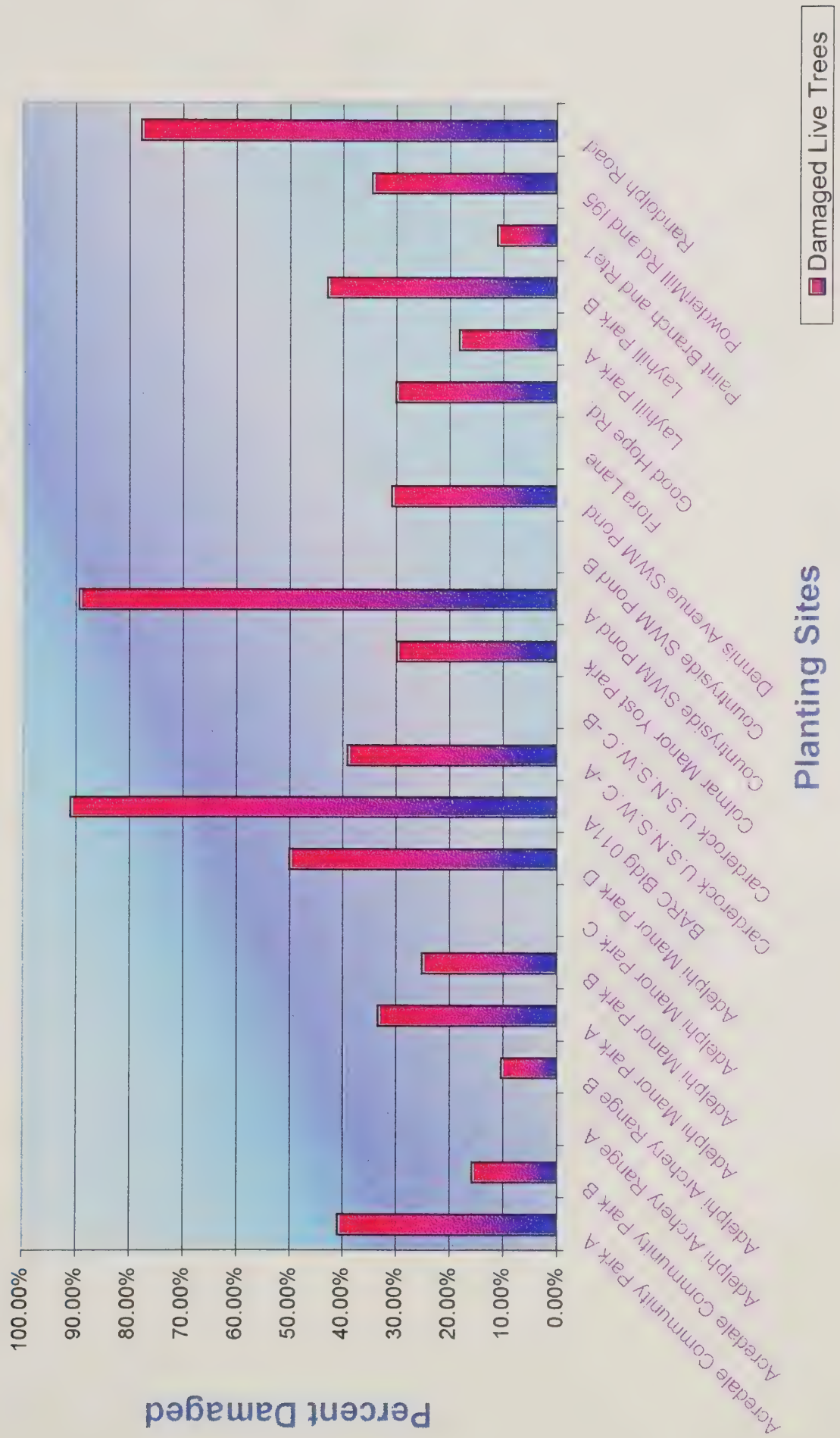
Figure 4B.

Container Trees per Acre Compared  
by Planting Season  
With Standard Error of Means.





**Figure 5.**  
**Percentage of Living Container Trees with Damage**





**Figure 6.**  
**Comparison of Leading Causes of Tree Damage in**  
**Anacostia Watershed Riparian Forest Buffer Plantings.**

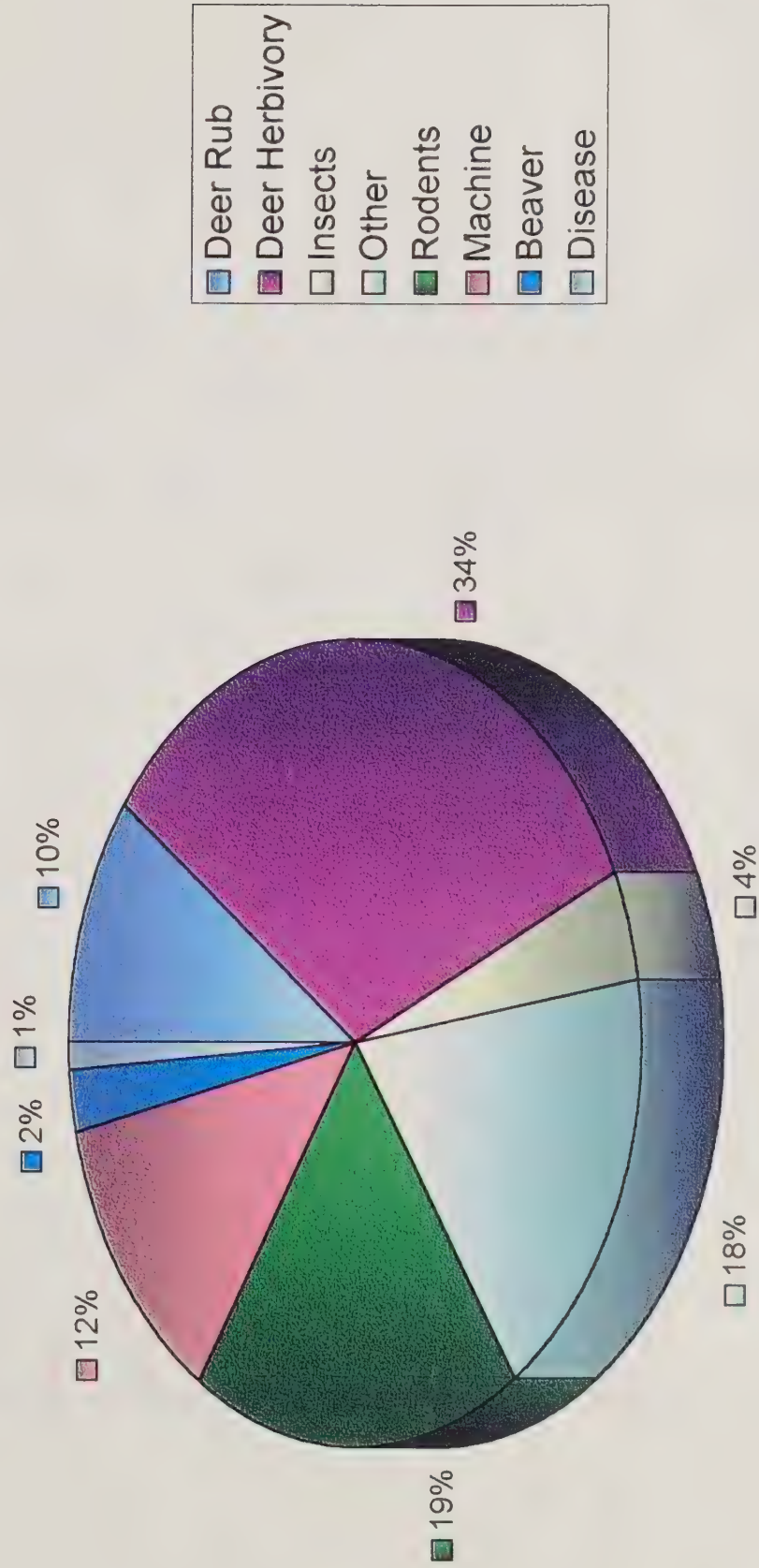




Figure 7.  
Sources for Announcing Community Events.

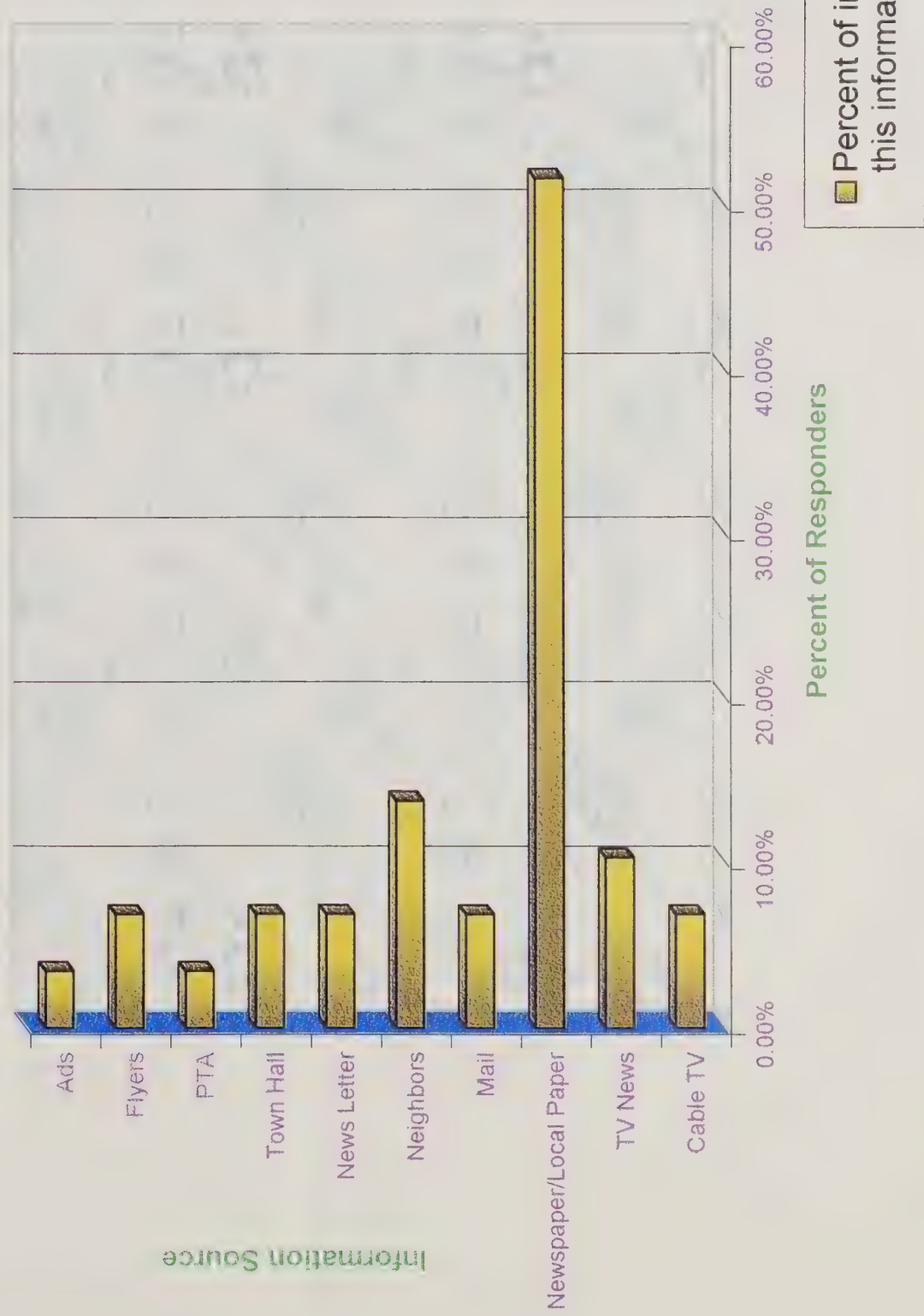




Figure 8.  
Comparison of Landowner Responses.

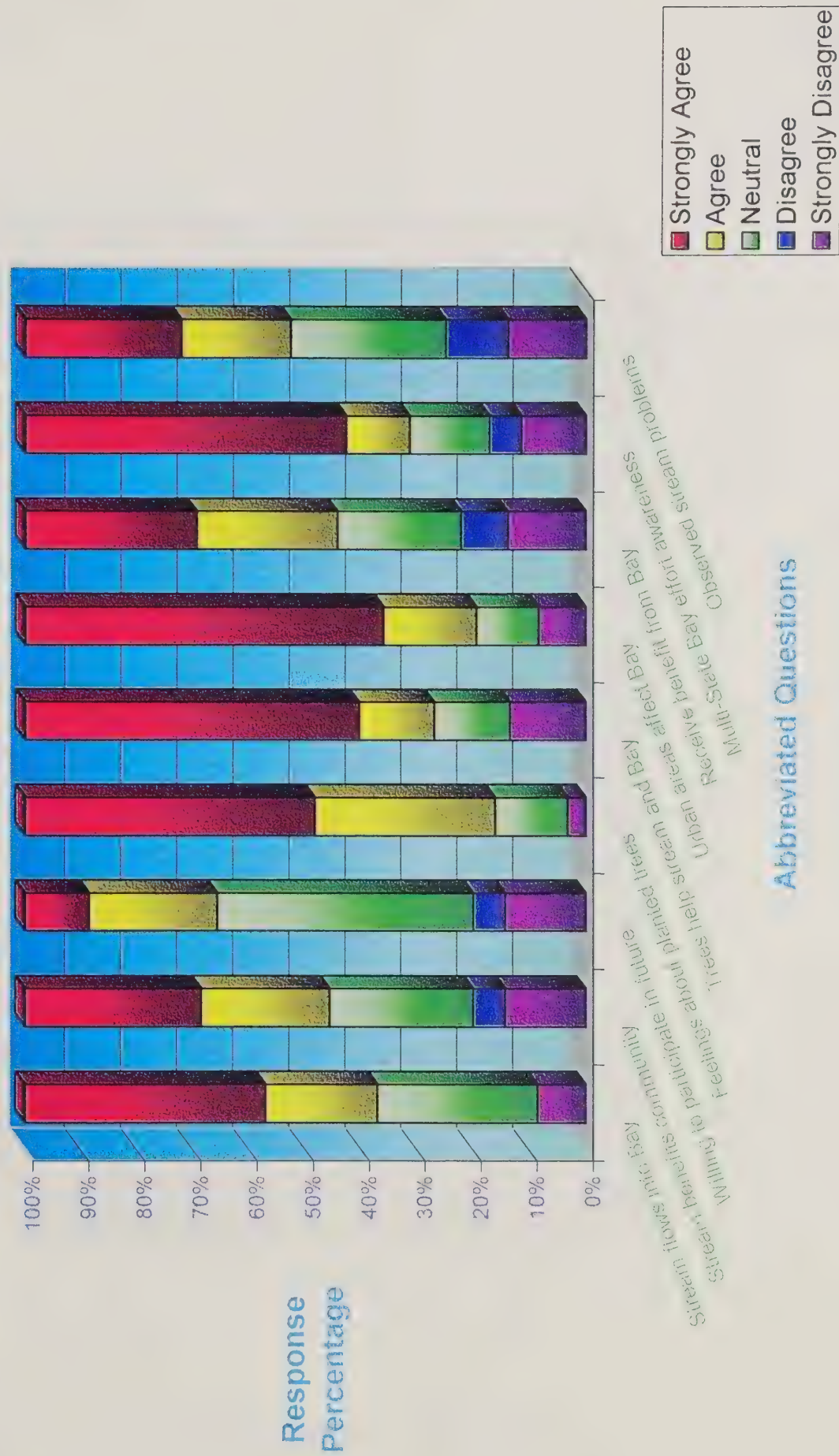




Figure 9.  
Land Owner Survey Responses.

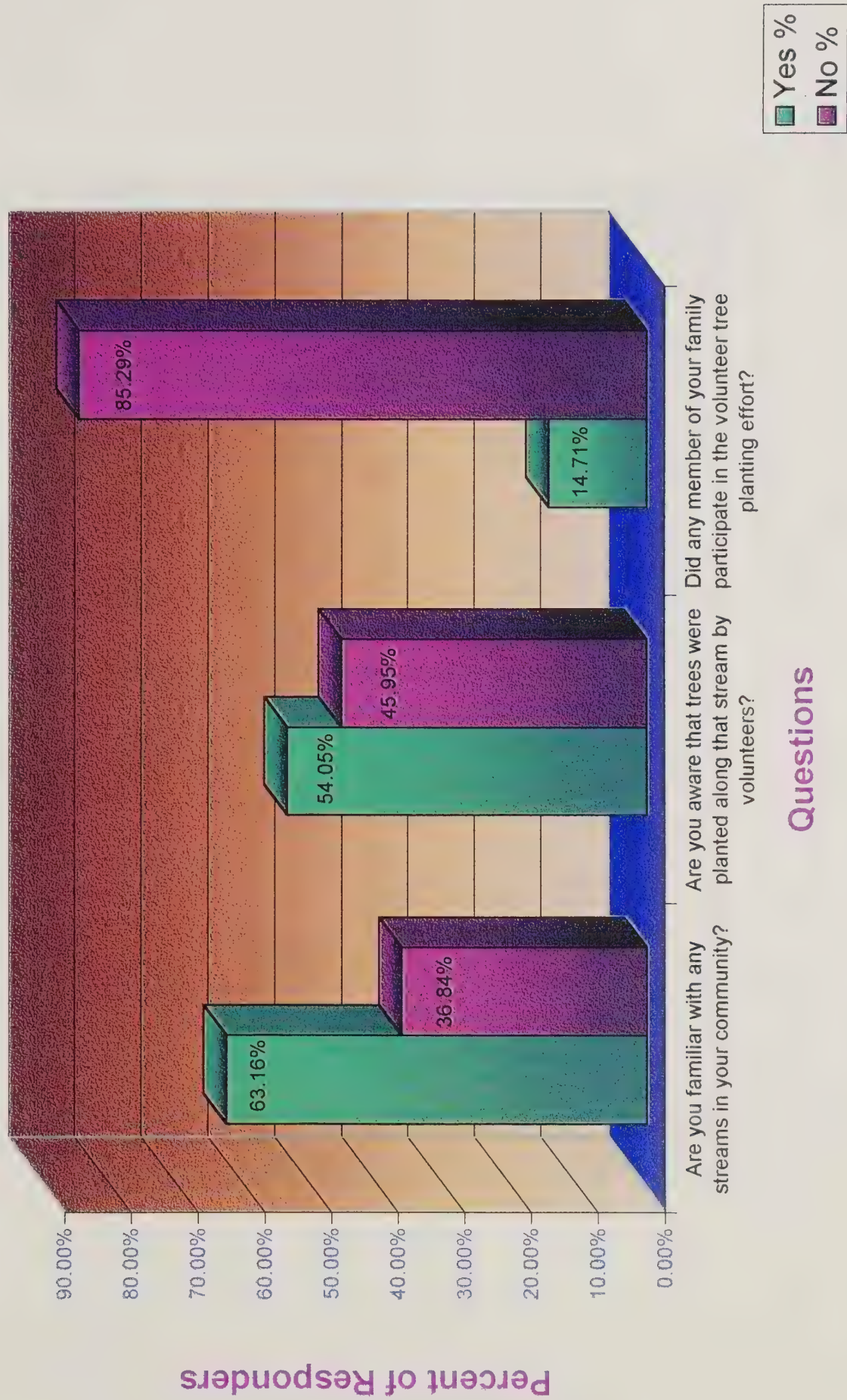




Figure 10.  
 Water Quality Problems Reported by Land Owners Residing in  
 the Anacostia Watershed.

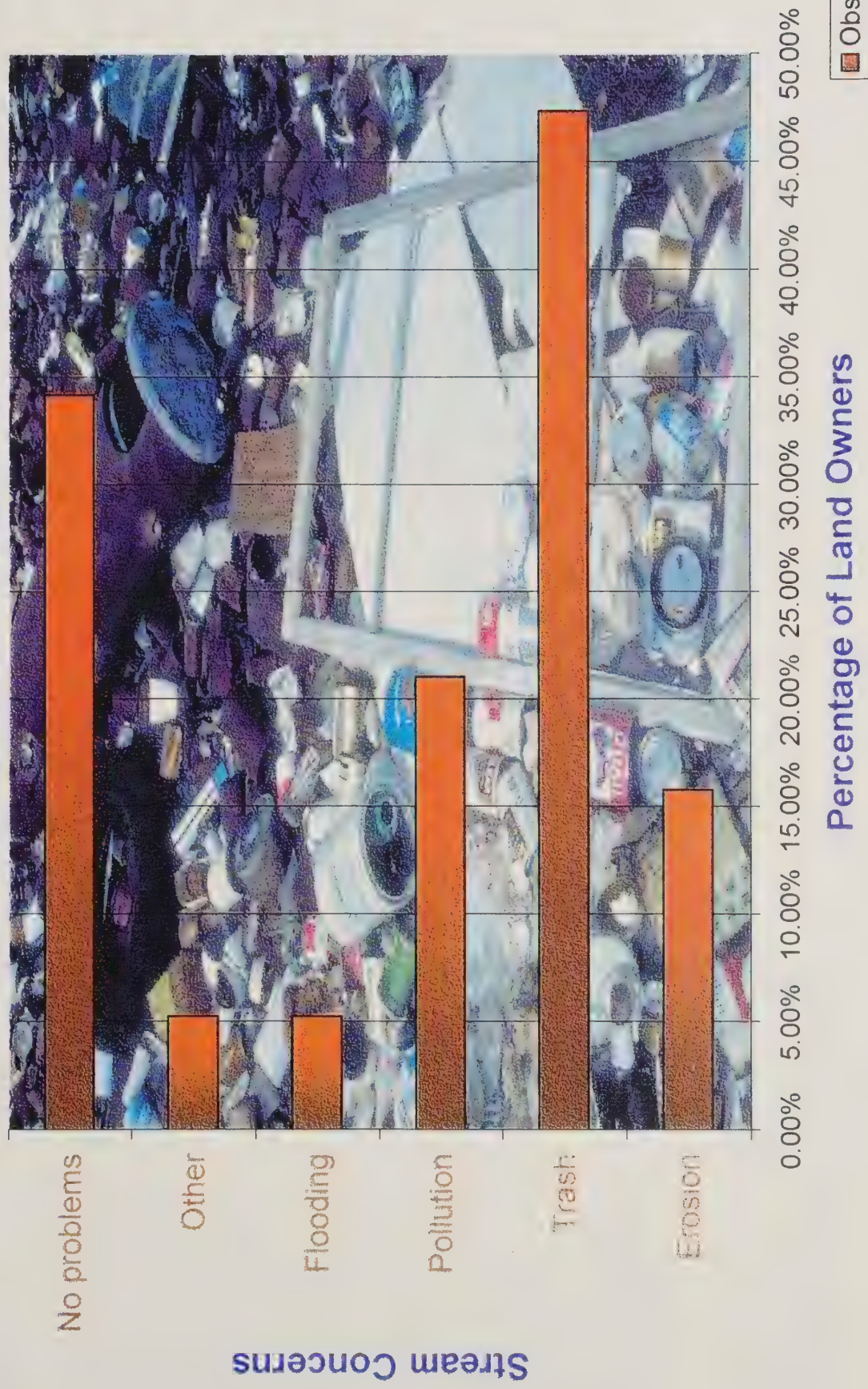




Table 1.

## Anacostia Watershed Riparian Forest Buffer Plantings

Site Name	Planting Season	Date	Seedlings Planted	Container Trees Planted	Trees/acre	Acreage	Average Width (Feet)	Length (Feet)	Sample Plot Size
Acredale Community Park A	Fall 94	11/19/94	100		235	384.00	0.82	61.9	709
Acredale Community Park B	Spring 95	3/18/95	100		122	246.67	0.78	128.25	265
Adelphi Archery Range A	Spring 96	3/30/96	280		40	440.00	0.54	69.2	365
Adelphi Archery Range B	Spring 96	4/13/96	317		65	393.33	0.46	66.2	300
Adelphi Manor Park A	Spring 95	??????	780		115	276.00	1	115.4	335
Adelphi Manor Park B	Fall 95	10/15/95	0		130	147.50	1.4	134.5	550
Adelphi Manor Park C	Spring 96	3/9/96	150		60	486.67	0.45	103.3	190
Adelphi Manor Park D	Spring 96	3/23/96	0		33	240.00	0.37	76.25	112
BARC Bldg 011A	Fall 95	??????	0		150	183.00	0.73	21.56	1440
Carderock U.S.N.S.W.C -A	Fall 95	10/19/95	0	450 (Tubelings)		250.00	1.78	206.7	585
Carderock U.S.N.S.W.C -B	Spring 96	4/23/96	250		0	1750.00	0.39	58.8	200
Colmar Manor Yost Park	Fall 96	10/26/96	0		610	372.64	1.89	43.05	1736
Countryside SWM Pond A	Fall 95	11/12/95	0		145	1540.00	0.66	85	329
Countryside SWM Pond B	Spring 96	3/16/96	180		0	583.33	0.36	50	300
Dennis Avenue SWM Pond	Spring 95	3/11/95	100		68	226.67	0.49	70.5	300
Flora Lane	Spring 94	4/30/94	1125		0	1300.00	0.91	37	1000
Good Hope Rd.	Fall 93	10/24/93	0		360	370.00	0.89	112	348
Layhill Park A	Spring 94	4/26/94	200		225	326.28	1.66	63.07	1225
Layhill Park B	Spring 95	4/23/95	300		42	412.50	0.53	101	220
Paint Branch and Rte1	Spring 95	4/8/95	200		70	466.67	0.52	63.5	350
PowderMill Rd and I95	Fall 93	10/17/93	0		40	258.00	0.33	54.8	300
Randolph Road	Spring 96	4/20/96	635		150	591.43	1.57	148	460

Total Length	11619
Average Width	85
Average Acreage	18.53
Average Trees per Acre	511.12



## **Appendix B**

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Riparian Forest Buffer Inventory Forms.



## ANACOSTIA WATERSHED RIPARIAN FOREST BUFFER INVENTORY

## SITE DESCRIPTION

Property Owner      Name: \_\_\_\_\_  
                                  Address: \_\_\_\_\_  
                                  \_\_\_\_\_

Location Site Name: \_\_\_\_\_  
County/Town: \_\_\_\_\_ Watershed: \_\_\_\_\_  
MD Grid# : \_\_\_\_\_ N; \_\_\_\_\_ E Sub-Watershed: \_\_\_\_\_  
Tax Map/Parcel# : \_\_\_\_\_; \_\_\_\_\_ 8-Digit Code: \_\_\_\_\_  
Stream Name: \_\_\_\_\_ Stream Order: \_\_\_\_\_  
ADC Map: County: \_\_\_\_\_ Map#: \_\_\_\_\_ Grid: \_\_\_\_\_ Edition: \_\_\_\_\_ Year: \_\_\_\_\_  
Landmarks: \_\_\_\_\_

Management/Assistance

Agencies Providing Technical Assistance: \_\_\_\_\_

Financial Assistance Used: \_\_\_\_\_

Primary Forester: \_\_\_\_\_

Pre-Planting Land Use: \_\_\_\_\_

### Planting Information

Date of Planting: \_\_\_\_\_  
 Soil Survey Type: \_\_\_\_\_  
 # Volunteers: \_\_\_\_\_ Hours: \_\_\_\_\_  
 Contract#: \_\_\_\_\_ Hand/Machine (circle one)

Species Planted      # Seedlings \_\_\_\_\_      # Container Trees \_\_\_\_\_

Comments

Form completed by: \_\_\_\_\_ Date completed: \_\_\_\_\_



# ANACOSTIA WATERSHED RIPARIAN FOREST BUFFER INVENTORY

## RESOURCE ASSESSMENT

Site Name: \_\_\_\_\_

### Adjacent Land Use

(circle all that apply)

Park/Recreational, Residential (High Density/Low Density), Forest,  
Meadow, Industrial, Agricultural, Commercial, Impervious Surface

Other: \_\_\_\_\_

Impacts: \_\_\_\_\_

Notes: \_\_\_\_\_

### Stream Condition

1. Banks (Sloughing): \_\_\_\_\_

2. Substrate embeddedness: \_\_\_\_\_

3. Water Quality

-Sedimentation: \_\_\_\_\_

-Odor: \_\_\_\_\_

-Discoloration: \_\_\_\_\_

-Suds/Froth: \_\_\_\_\_

-Algae: \_\_\_\_\_

-Other: \_\_\_\_\_

-Notes/Comments: \_\_\_\_\_

4. Excessive debris or trash? \_\_\_\_\_

### Soil Condition

-Natural or fill? \_\_\_\_\_

-Compaction: \_\_\_\_\_

-Rocks, debris, rubble: \_\_\_\_\_

-General assessment (good site/bad site): \_\_\_\_\_

### Wildlife Habitat

-Observed species: \_\_\_\_\_

-Potential species: \_\_\_\_\_

-Damage (deer, beaver, etc.): \_\_\_\_\_

### Forest Buffer Potential

-Upstream: \_\_\_\_\_

-Downstream: \_\_\_\_\_

-Other side of stream: \_\_\_\_\_

-Continuity/contiguity: \_\_\_\_\_

### Existing Signage

Number: \_\_\_\_\_

Type: \_\_\_\_\_

### Comments

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Form completed by: \_\_\_\_\_

Date completed: \_\_\_\_\_



# ANACOSTIA WATERSHED RIPARIAN FOREST BUFFER INVENTORY

## **PLANTING INFORMATION/DATA ANALYSIS**

Location \_\_\_\_\_  
\_\_\_\_\_

### Stream Buffer Information

Buffer Length: \_\_\_\_\_  
Buffer Width(Avg): \_\_\_\_\_  
Buffer Acreage: \_\_\_\_\_

# of Plots: \_\_\_\_\_ Sampling Method: \_\_\_\_\_  
% Survival: \_\_\_\_\_ Date of Survey: \_\_\_\_\_

### Tree Survival

	<u>Trees/Acre</u>	<u>%Damaged</u>	<u>%Dead</u>
B&B/containered:	_____	_____	_____
Seedlings:	_____	_____	_____
Natural Regeneration:	_____	_____	_____
Total:	_____	_____	_____

### Invasive Species

Type: \_\_\_\_\_  
Extent: \_\_\_\_\_  
Potential: \_\_\_\_\_

### Damage (Site as a whole)

-Human/Mechanical: \_\_\_\_\_  
-Wildlife: \_\_\_\_\_  
-Natural (fire, flood, etc.): \_\_\_\_\_

Maintenance Requirements \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### Overall Success of Planting

Success                      Needs Work                      Failure

Comments \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Form Completed by: \_\_\_\_\_ Date Completed: \_\_\_\_\_



# ANACOSTIA WATERSHED RIPARIAN FOREST BUFFER INVENTORY

## DATA SHEET

Plot # \_\_\_\_\_ Sample Size: \_\_\_\_\_ Form completed by: \_\_\_\_\_

N	Species	Type	Damaged	Dead	Invasive Species	Maintenance Required	Notes
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Plot# \_\_\_\_\_ Sample Size: \_\_\_\_\_

N	Species	Type	Damaged	Dead	Invasive Species	Maintenance Required	Notes
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Damage Key: **DB**: Deer Browse; **DR**: Deer Rub; **M**: Machine; **R**: Rodent Impact  
**I**: Insects; **D**: Disease; **V**: Vandalism; **O**: Other (include in notes)



# **Appendix C**

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Landowner Survey Form.



**Maryland Department of Natural Resources  
ANACOSTIA WATERSHED QUESTIONNAIRE**

The Maryland DNR, Forest Service is conducting a survey in this community to determine interest in local streams and the Chesapeake Bay. Your cooperation would be greatly appreciated. The survey will only take a few minutes.

Key: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree

**GENERAL**

1. How long have you lived in this area? \_\_\_\_\_ years
  2. How do you find out about events happening in your community?
- 

**STREAMS**

1. Are you familiar with any streams in your community?  
\_\_\_\_\_ YES \_\_\_\_\_ NO If so, stream name: \_\_\_\_\_
2. This stream eventually flows into the Chesapeake Bay.  
1 2 3 4 5
3. Your community benefits from this stream.  
1 2 3 4 5
4. I have noticed problems with this stream.  
1 2 3 4 5
5. Such as: \_\_\_\_\_ Erosion \_\_\_\_\_ Trash \_\_\_\_\_ Pollution  
\_\_\_\_\_ Flooding \_\_\_\_\_ Other

**FORESTS**

1. Are you aware that trees were planted along that stream by volunteers in  
\_\_\_\_\_ (year)?  
\_\_\_\_\_ YES \_\_\_\_\_ NO
2. If so, did you or anyone in your family participate in the volunteer tree  
planting effort?  
\_\_\_\_\_ YES \_\_\_\_\_ NO
3. I would like to participate in future tree plantings.  
1 2 3 4 5
4. How do you feel about the trees that were planted?  
1 2 3 4 5
5. Comments: \_\_\_\_\_

**CHESAPEAKE BAY**

1. I am aware that trees help this stream and the Chesapeake Bay.  
1 2 3 4 5
  2. Urban areas have an effect on the health of the Bay.  
1 2 3 4 5
  3. Do you or your family receive any direct benefits from the Bay?  
1 2 3 4 5
  4. I am aware of the Multi-State effort to clean up the Chesapeake Bay.  
1 2 3 4 5
  2. Comments: \_\_\_\_\_
- 

Thank You



# **Appendix D**

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## **Planting Site Summaries.**



## Acredale Community Park

**Planting A** was planted with 235 container trees and an estimated 100 seedling trees in the fall of 1994. Tree survival for the planting was found to be 54.60% with container tree survival at 61.16% far higher than seedling survival at 39.20%. The total number of stems per acre of 384 is acceptable especially when considering the contribution of nearly half this figure by well developing container trees. This site also has a large number of naturally regenerating trees and is well along in the successional process towards becoming an established riparian forest. The site does contain very heavy herbaceous growth in areas as well as several invasive plant species. Morning glory (*Ipomoea purpurea*) and wild grape are impacting trees at this site and are responsible for pulling at least two trees down. Multiflora rose (*Rosa multiflora*) is also present and has potential to become problematic. Recent construction of a bike path has impacted parts of this planting and removed some of the original planting area, as well as compacting soils adjacent to the bike path. Rodents appear to be the major cause of tree damage at this site, afflicting nearly one fourth of the surveyed trees. Heavy herbaceous growth and invasive competition early after the initial planting is likely responsible for the low seedling tree survival. Mulching and removal of invasive vines would aid this planting site's development. Spot planting of gaps would aid aesthetics along the bike path, but is unnecessary due to the high rate of natural regeneration.

**Planting B** was conducted in the spring of 1995, resulting in the planting of 122 container trees and 100 seedling trees. The tree survival was excellent at 72.6%, with 80.98% of the container trees surviving despite destruction of a 50 by 150



foot area of buffer. The area of buffer destroyed was used as a construction storage area during the recent construction of a bike bath following the Paint Branch. The undisturbed area of the planting is flourishing with only minor damage from rodents and drought stress. The area of buffer lost from the construction can be replanted, but will be complicated by highly compacted soils. Heavy herbaceous growth and some thistle are present, but are not out competing the planted trees.

### **Adelphi Archery Range**

**Planting A** was completed in the spring of 1996 at the southern end of the Adelphi Archery Range. Forty container trees and 280 seedlings were planted here. This site has a low seedling survival of 43.92%, lowering overall survival to 47.47% despite the success of the container trees of which 72.34% survived. The poor seedling survival is a result of the heavy presence of mile-a-minute, honeysuckle (*Lonicera japonica*), and multiflora rose. Tall grass and weeds are also competing with the seedling trees. Otherwise, this site has very little tree damage. Natural regeneration has been able to occur despite competitive pressures with an average of 160 volunteer trees per acre.

**Planting B** was also finished in the spring of 1996 with the planting of 65 container trees and 317 seedlings. This site has a very high container survival, but seedlings fared poorly with only 25.35% surviving, lowering total survival to around 45%. Despite poor seedling survival and low natural regeneration, the site is becoming a riparian forest with slightly under 400 stems per acre. Japanese beetles have damaged less than 8% of the container trees and was the only observed source of damage. Mile-a-minute has invaded this site and is applying heavy competitive



pressure to the planted trees. When surveyed, the soils at this site were light alluvial deposits and very dry. This planting could benefit from a small reinforcement planting of container trees.

### **Adelphi Manor Park**

**Planting A** was conducted in the spring of 1995 and was the first of several stages of establishing a riparian forest along the stream bank in Adelphi Manor Park. One hundred and fifteen container trees were planted here and 94.12% are still surviving. An estimated 780 seedlings have also been planted at this site on three separate occasions. Seedling survival has been very poor at slightly under 20%. This is a result of heavy competitive pressure from very thick fescue and some mile-a-minute growth. Deer rubbing and herbivory have both affected 11% of the surveyed container trees. Rodents and drought stress are the leading causes of seedling damage. This site would benefit from an additional planting of some container trees where the seedlings have been failing. Before reinforcing this site, the soil should be checked to see if amendments are needed. The container trees should be able to out compete the thick grass with much higher success than seedlings. Removal of the mile-a-minute is recommended.

**Planting B** consisted of 130 container trees planted in the fall of 1995. Surviving container tree density is a respectable 120 trees per acre. Twenty-five percent of the trees were damaged as a result of drought stress, deer, and rodents. Beaver were responsible for 60% of the observed dead container trees. A muskrat also inhabits this planting site and has killed some of the willow stakes planted to stabilize the stream



bank. Mile-a-minute, honeysuckle, wild grape, and heavy fescue are all competitive factors.

**Planting C** was completed in early spring of 1996. At the time of planting, the ground and root balls of the trees were frozen and temperature is largely responsible for the poor 28.6% total tree survival. High natural regeneration of black walnut (*Juglaus nigra*), green ash (*Fraxinus pennsylvanica*), boxelder, river birch (*Betula nigra*), and black locust (*Robinia pseudoacacia*) makes up for poor planting survival bringing the total stems per acre up to 486. Provided natural regeneration continues at this rate, this site will remain acceptable. Trees at this site had very little damage with insects affecting only 8% of seedlings. Soils here are compacted. Wild grape, poison ivy (*Toxicodendron radicans*), and thick herbaceous competition are also present here.

**Planting D** was completed in the spring of 1996 with the planting of 33 container trees. Container tree survival was poor at 45%. Beavers are responsible for this low survival rate having killed 40% of the observed dead trees. 50% of the container trees have damage from rodents, drought stress, or deer herbivory. Adequate natural regeneration raises stems per acre to 240. A reinforcement planting would be recommended for this site except that the presence of beaver will cause high tree mortality.

An old beaver dam upstream of these plantings has caused the accumulation of an extremely large amount of trash and debris. Although several stream clean-ups have been conducted here, this is a recurring problem. More frequent stream clean-ups are recommended as this is a good place to remove trash before it reaches further downstream.



### **Beltsville Agricultural Research Center Building 011A**

This planting site was completed in the fall of 1995 with the planting of 150 container trees. Over 73% of the container trees have survived but of these, almost 91% have been damaged from repeated improper mowing and trimming. Natural regeneration has been severely inhibited by the mowing and is restricted to the narrow area immediately adjacent to the stream. The 183 trees per acre is still an acceptable density due to the almost complete composition of established container trees. Mile-a-minute has managed to gain a foothold in this site, but may still be controlled if it is removed quickly. The stream at this site was the healthiest of any seen throughout the inventory process. The stream had crystal clear, cool water and a good substrate. Aquatic plants dominated the stream providing food and habitat for aquatic wildlife. This site will become an excellent riparian forest when mowing in the buffer area is halted.

### **Carderock U.S. Naval Surface Warfare Center**

**Planting A** consisted of the planting of 450 tubelings in the fall of 1995. Tree survival was an excellent 81.23% with tree density at 250 stems per acre. The grass at this site had laid down flat and was not very thick. Even though very little plant competition was present and natural tree seed sources were nearby, natural regeneration was surprisingly low at 45 trees per acre. Small rodents were responsible for damaging over 34% of the tubelings. Most of the observed dead trees had leafed out in the spring and probably died from drought stress. This site is a success and will remain so as long as the tubelings continue at their present rate of growth until they become fully established.



**Planting B** was completed in spring of 1996 with 250 seedlings being planted.

This site is an outstanding success with over 94% of the seedlings still surviving.

Combined with outstanding natural regeneration from nearby seed sources and low competitive pressure, this site has over 1750 stems per acre. A large percentage of the natural regeneration is from box elder. Honeysuckle and blackberry (*Rubus spp.*) are beginning to invade this site and could jeopardize the success of this planting. The trees are still small enough that they could be smothered by these invasive species. A maintenance project for the removal of the honeysuckle and blackberry would insure the success of this planting and is highly recommended.

#### **Colmar Manor, Yost Park**

This planting was the largest volunteer tree planting undertaken by the Anacostia Watershed Project. Six hundred and ten container trees were planted in this highly publicized event in the fall of 1996. Over 75% of the trees are surviving, giving this site an excellent density of 243 container trees per acre. Combined with natural regeneration, the site has 372 stems per acre making it well on it's way to becoming an established riparian forest. The stream at this site was blown out and showed signs of recent flooding. A recent arson fire had also denuded an area uphill from the planting and was found to be a source of sediment entering the buffer. It is difficult to realize this planting is located on the hillside of a former landfill. The only significant cause of tree damage was found to be drought stress, affecting almost 30% of the trees. Natural regeneration consisted of green ash, mulberry (*Morus rubra*), bradford pear (*Pyrus calleryana* "Bradford"), crab apple (*Malus spp.*), black cherry (*Prunus serotina*), and



button bush (*Cephalanthus occidentalis*). Competitive pressures arose from thick fescue, heavy herbaceous growth, thistle, morning glory, and blackberry.

### **Countryside Storm Water Management Pond**

**Planting A** was completed in the fall of 1995 and included the planting of 145 container trees on a hillside parallel to the storm water management pond outflow. Sixty-three percent of the planted trees have survived at about 140 container trees per acre. Heavy red maple regeneration raises total stems per acre to over 1540. Deer are very problematic at this site having rubbed 21% and browsed 71% of the container trees. Rodents have also affected 25% of container trees. Poison ivy, thistle, and multiflora rose are invasive species present in the planting site. High grass is creating the most competitive pressure here. Several birdhouses are located in the planting area and provide nesting for several pairs of blue birds.

**Planting B** was conducted in the spring of 1996 along a bike path on the opposite side of the stream from planting A. Of the 180 seedlings planted, 79% have survived for a seedling density of 450 trees per acre. Tree density is raised to 583 trees per acre when including natural regeneration. Japanese beetles were affecting 8% of the trees surveyed and were only found on sycamore trees (*Platanus occidentalis*). No other damage was observed at this site. Parts of this site were heavily overgrown with thistle, honeysuckle, multiflora rose, wild grape, some mile-a-minute, and dense bramble thickets. Provided the seedlings are not smothered out by the competing plant growth, this site will establish itself. Removal of the competing vegetation is probably impractical due to its severe extent. It is important for this reason to maintain sites so



that invasive species do not have the opportunity to dominate a planting site like they have accomplished here.

### **Dennis Avenue Storm Water Management Pond**

This planting consisted of 68 container trees and 100 seedlings planted in the spring of 1995. Tree survival was poor due to extremely compacted soils, periodic flooding, and very thick and tall herbaceous competition. Container trees fared respectably with 61.8% surviving, but seedling survival was low at 38%. Natural regeneration was also poor, contributing only 60 of 226 trees per acre for the planting site density. The site contained a lot of trash and debris from storm water runoff. Several deer were observed in the planting site explaining why 23% of the container trees were rubbed by deer and 8% of the seedlings browsed. Multiflora rose was present in several plots at this site.

### **Flora Lane**

This planting was undertaken in the spring of 1994 to reforest a section of stream after a stream restoration project. One thousand one hundred twenty-five seedlings were planted of which 30% have survived. The 375 seedling trees per acre would not be sufficient alone for this planting site to be considered a success. Fortunately, heavy natural regeneration of red maple and American hornbeam (*Carpinus caroliniana*) raise tree density to 1300 trees per acre. The trees are establishing themselves and dominating the site. This site will soon be an established riparian forest. The only damage to the trees at this site was slight and caused from deer rubbing.



### **Good Hope Road**

Three hundred sixty container trees were planted here in the fall of 1993. 61% of the container trees have survived contributing 250 of the total 370 trees per acre. The other 120 trees per acre are from natural regeneration. 30% of the trees at this site were damaged. Damage was caused from deer herbivory, drought stress, insects, and rodents (by order). Protective tubes around the tree bases may have prevented damage from deer rubbing. This site has already become established and provides a wide buffer (of an average 112 feet) for the adjacent stream. Invasive species include thistle and multiflora rose. Vines are also adding competitive pressure to the trees. One resident claimed that all terrain vehicles were responsible for the loss of several trees.

### **Layhill Park**

**Planting A** was completed in the spring of 1994 with the planting of 225 container trees and 200 seedlings. Planting survival was a good 73.25%. Seedling survival was 79.69% and higher than container tree survival of 67.53%. With natural regeneration, the site has an over all density of 326 trees per acre. This site had very heavy herbaceous growth with weeds over seven feet tall in places. This placed very high competitive pressure on trees in these areas. Blackberry and multiflora rose were also prevalent throughout the site. Beaver was the largest cause of container tree damage affecting 18% of the surveyed trees. Beavers were also responsible for killing the only observed dead tree. Several other container trees were missing in the beaver area.



**Planting B** consisted of 300 seedlings and 42 container trees planted in the spring of 1995. Although this site had nearly 100% container tree survival, only about 44% of the seedlings survived. The total planting density is 412 trees per acre comprised of more than half by seedlings. Honeysuckle, mile-a-minute, and multiflora rose are all invasive species influential in the future development of the planting site, and should be prevented from dominating the buffer.

#### **Paint Branch and U.S. Route 1**

Planted in the spring of 1995, this site was initially planted with 70 container trees and 200 seedlings. Tree survival was 44% and almost equal for container trees and seedlings. Good natural regeneration raises the density to 466 trees per acre, and will ensure the future establishment of this buffer planting as a riparian forest. Rodents had a high impact in this site damaging 38% of observed seedlings and 11% of observed container trees. Multiflora rose, thick fescue, and honeysuckle are prevalent in the planting area. A beaver has felled some of the older natural trees along the Paint Branch, but had left the planting site alone at the time the planting was surveyed. Recent construction adjacent to the site has likely caused damage to the planting since the time the inventory was taken.

#### **PowderMill Road and Interstate 95**

Of the 40 container trees planted at this site in the fall of 1993, 72.5% have survived and are flourishing. Eighty-nine container trees per acre, combined with 169 volunteer trees per acre, equal a total planting density of 258 trees per acre. The container trees at this site have truly established themselves and have grown healthy



and tall. Despite the lower tree density, this site is developing into a riparian forest. All of the four yellow poplar (*Liriodendron tulipifera*) trees planted at this site were found to be dead along with 3 of the 5 planted red maples. This has left a decent size clearing in the middle of the buffer, but a reinforcement planting is not necessary due to the remote location of this site and the adequate natural regeneration. Several deer were observed at this location, which is in the southwest loop of an exit ramp from Interstate 95. Large thickets of vines, brambles, honeysuckle and blackberry are impacting several of the trees despite their height. Invasive species control would make certain that this site remains healthy and continues to develop. Thirty-five of the trees were damaged, with deer rubbing causing damage to 10% and deer herbivory impacting 20% of the planted trees.

#### **Randolph Road**

This planting was conducted in the spring of 1996. One hundred fifty container trees and 635 seedling trees were planted in a 1.5-acre area adjacent to the Northwest Branch. Tree survival was excellent and almost equal for container trees and seedlings with 81.5% of the planted trees surviving. The stream buffer tree density was found to be an outstanding 591 trees per acre. Deer herbivory affected 74% of surveyed container trees, 64% of seedlings, and 53% of volunteer trees. Although deer-rubbing damage was low, deer are a major problem at this site. Many seedlings were protected by Tubex tree shelters, but were still browsed where shoots and leaves extended out of the tops of the shelters. Japanese beetles damaged the leaves of 7.4% of the trees, all of which were sycamores. Invasive species present included thistle, multiflora rose, and the beginning of a mile-a-minute infestation. Applying fresh mulch to container trees



would lower competition at this and many other sites. Despite these few problems, this planting site is becoming established and looks good.









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